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# Field Efficacy of Insecticide Molecules Against Pod Borer Complex in Vegetable Field Bean

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## Abstract

Field experiments were conducted at Regional Research Station farm, Paiyur, India during 2014-2016 in vegetable field bean under rain fed conditions to study the efficacy of insecticide molecules viz., Novaluran, Rynaxiper, Emamectin benzoate, Spinosad, Flubendanide, and Indoxicarb along with untreated check was evaluated for the management of vegetable field bean pod borer complex. The two season results indicate that Flubendanide 480 SC 0.4 ml/lit was found to be the best chemical for the management of pod borer complex in vegetable field bean (Mochai) in terms of higher larval reduction (96.1 per cent), lower pod damage (4.40 per cent) translating into higher green pod yield (2,340 Kg/ha) and monetary returns (Rupees 15,853 net profit/ha) with no residue deducted at test concentration. The other promising treatments with distinct advantage were Indoxicarb 14.5 SC @ 0.5 ml/lit and Emamectin benzoate 5 SG 0.2 g/lit which can be used for cost effective management of pod borer complex in field bean

***Keywords:*** Pod borers; Novaluran; Rynaxiper; Emamectin benzoate; Spinosad; flubendamide; Indoxicarb

## Introduction

Field bean belongs to the family leguminosae, is an important pulse cum vegetable crop in India and it is cultivated extensively for its fresh tender pods, leaves and seeds and as cattle feed. In India this is grown mostly in Andhra Pradesh, Karnataka, Tamil Nadu, Kerala and Assam and the fresh and the dried seeds constitute major vegetarian source of proteins in the diet and are rich in nutritive value and are rich source of carbohydrates, minerals, vitamins, such as vitamin A, Vitamin C, fat and fibre. The protein content of field bean is quite high varying from 20.0 to 28.0 per cent (Schaffhausen R.V.1963). The primary cause attributed for lower yields of field bean is due to the heavy infestation of an array of pest complex. Govindan 1974 recorded as many as 55 species of insects and a species of mite feeding on the crop from seedling stage to the harvest of the crop in Karnataka and considered the pod borers as important as they cause 80- 100 per cent loss. Naik et al., (2009) reported pod borers as key impediments for the low productivity causing a loss of 54 per cent in field beans. The major yield loss is inflicted by the pod feeders which include both the pod borers and the pod bugs. Pesticide use has increased rapidly over the last two decades at the rate of 12 per cent per year and the extensive, irrational use of pesticides resulted in the presence of residues of insecticides on different edible plant parts resulting in various public health problems and ill effects on environment. The increasing amount pesticide residues in vegetables is a major concern to the consumers as the insecticides leave residues on pods which may persist up to harvest (Srinivasa et al., 2018) affecting export and sometimes rejection of consignments. Hence the available insecticides in practice for control of pod borers were evaluated to observe and study the population reduction of pod borers in terms of efficacy of the insecticide molecule, cost effectiveness and ultimate benefit to end users.

## Materials and Methods

### *Susceptibility of insecticides against borer pest*

The susceptibility of six available insecticides along with untreated check was test verified against borer pest complex of field bean at RRS, Paiyur, during *Kharif* 2013-14 & 2014-15 replicated thrice were subjected to evaluation in randomized block design. The tested variety was one of the advanced pre release culture viz., PYR 03-007 (Sel. from CO6A) in the first year &PYR 03-004 (Sel. from DL 2564) in the second year under rainfed conditions with a plot size of 5×4 m, sown 90 × 60 cm. The crop was raised under rainfed conditions with recommended package of practices and adoption of plant protection measures as per the treatments. Application of insecticides was made with high volume sprayer. The efficacy of insecticide was accounted on larval reduction of lepidopteron pod borer complex over control & pod damage due to lepidopteron pod borers at 7 DAT & 14 DAT observed in five randomly selected plant pods. Percentage reduction of pest population over control was calculated by using modified Abbot's formula as follows.

$$P = 100 \times 1 - \frac{[Ta \times cb]}{Tb \times ca}$$

Ta = Population in treatment after spraying ; Tb = Population in treatment before spraying; Ca = Population in control after spraying & Cb = Population in control before spraying.

Net plot yield was extrapolated per ha yield. Incremental cost benefit ratio was worked out on the realized net profits, considering the cost of plant protection, which exhibits the economic viability through the view point of management of pod borer infesting field bean.

## Results

### *Per cent larval reduction, 7 days after treatment, over control*

***H.armigera***: 7 days after application of Flubendamide 480 SC @0.4 ml/lit (Table 1) higher significant reduction of 96.1 per cent *H. armigera* larval population was observed & superiority of the treatment was exhibited. The next effective significant treatment was application of Rynaxiper 10 SC@ 0.1 ml/lit & Emamectin Benzoate 5 SG @ 0.2 g/lit which registered 92.0per cent& 89.5 per cent reduction respectively in *H. armigera* larval population, over control.

***Excelestis atomosa*** (Plume moth larvae): Effect of various treatments, 7 days after treatment, on per cent reduction of *E.atomosa* larval population, over control, (Table-1) revealed statistical significance of all the treatments over untreated control. Rynaxiper 10 SC@0.1 ml/lit was most promising (91.5 % reduction) and remained parity with Emamectin Benzoate 5 SG @0.2 g/lit(87.8 %) in repressing *E.atomosa*, however, flubendamide 480 SC @0.4 ml/lit (83.9%) and spinosad 45 SC @0.1 ml/lit(77.3%) have also expressed efficacy in reducing the population over rest of the treatments, administered against this pest in the crop.

### *Per cent larval reduction, 14 days after treatment, over control*

***H.armigera***: Larval reduction of *H.armigera* to the extent of 95.4,93.5,93.0,92.0 and 85.5 per cent reduction over control, was recorded (Table 1)due to treatment of Flubendamide 480 SC @0.4 ml/lit., Rynaxiper 10 SC@0.1 ml/lit., Emamectin Benzoate 5 SG @ 0.2 g/lit., Spinosad 45 SC @ 0.1 ml/lit., & Indoxicarb 14.5 SC@0.5 ml/lit respectively.

***E. atomosa***: Data on larval reduction (%) in *E.atomosa*, 14 days after treatment (Table-1) revealed that treatment with Rynaxiper 10 SC@ 0.1 ml/lit., Flubendamide 480 SC @0.4 ml/lit., and Emamectin Benzoate 5 SG @ 0.2 g/lit was highly potent in restricting the plume moth larvae with 96.3,93.3 and 92.1 per cent reduction over control, respectively The later treatments were statistically at par with rynaxipyr, the best treatment.

| *Treatment Details* | *Mean reduction (%) Helicoverpa larvae over control (2013-2014)* | | *Mean reduction (%) Plume moth larvae over control ( 2014-2015)* | |
|---|---|---|---|---|
| | *7DAT* | *14DAT* | *7 DAT* | *14 DAT* |
| Novaluran 10 EC@ 0.7 ml/lit | 53.3 | 63.6 | 39.1 | 53.7 |
| Rynaxiper 10 SC@ 0.1 ml/lit | 92.0 | 93.5 | 91.5 | 96.3 |
| Emamectin Benzoate 5 SG @ 0.2 g/lit | 89.5 | 93.0 | 87.8b | 92.1 |
| Spinosad 45 SC @ 0.1 ml/lit | 87.2 | 92.0 | 77.3 | 86.5 |
| Flubendamide 480 SC @0.4 ml/lit | 96.1* | 95.4 | 83.9 | 93.3 |
| Indoxicarb 14.5 SC@0.5 ml/lit | 85.0 | 85.5 | 68.7 | 77.9 |
| Untreated check/control | 0.0 | 0.0 | 0.0 | 0.00 |
| SEM | 2.45 | 3.34 | 2.35 | 1.93 |
| CD(0.05) | 7.54 | 10.28 | 7.25 | 5.95 |

***Table 1:*** Insecticidal effectiveness on H.armigera and E.atomosa populations and their reduction (%) in field bean.

### *Per cent pod damage by lepidopteron pod borers*

Data on mean pod damage (%) (Table 2) revealed that lowest per cent pod damage due to lepidopteron pod borers (*H.armigera* and *E. atomosa*) was recorded due to application of Flubendamide 480 SC @0.4 ml/lit (4.4 %). It was followed by Rynaxiper 10 SC@ 0.1 ml/lit (4.5 %) and Emamectin Benzoate 5 SG @ 0.2 g/lit (4.7 %), at par with the superior treatment. Spinosad 45 SC @ 0.1 ml/lit was next in order of efficacy (5.7 %), statistically inferior to promising treatments. On the other hand, untreated control plot had maximum lepidopteron pod borer damage of 15.9 per cent.

| *Treatment No.* | *Treatment Details* | *Lepidopteron pod borer damage (%)* |
|---|---|---|
| 1. | Novaluron 10 EC @ 0.7 ml/lit | 10.7 |
| 2. | Rynaxiper 10 SC @ 0.1 ml/lit | 4.5 |
| 3. | Emamectin Benzoate 5 SG @ 0.2 g/lit | 4.7 |
| 4. | Spinosad 45 SC @ 0.1 ml/lit | 5.7 |
| 5. | Flubendamide 480 SC @0.4ml/lit | 4.4 |
| 6. | Indoxicarb 14.5 SC @ 0.5 ml/lit | 7.4 |
| 7. | Untreated check/control | 15.9 |
| | SEM | 0.33 |
| | CD(0.05) | 1.01 |

***Table 2:*** Effectiveness of insecticides on different pod borers in terms of per cent pod damage in field bean.

### *Green pod yield*

Green pod yield data (Table 3) revealed statistically similar ability of Rynaxiper 10 SC @ 0.1 ml/lit., Flubendamide 480 SC @0.4 ml/lit., Spinosad 45 SC @ 0.1 ml/lit and Emamectin Benzoate 5 SG @ 0.2 g/lit to translate in higher yield ranging from 2,260 Kg/ha to maximum of 2,340 Kg/ha respectively. It was followed by Indoxicarb 14.5 SC @ 0.5 ml/lit (2,180 kg/ ha) and Novaluron 10 EC @ 0.7 ml/lit which remained in parity but were lagging statistically to the most promising treatment and recorded lower green pod yield but superior over untreated control.

### *Net profit and ICBR*

Net monetary returns as a function of effect of various treatments, over two seasons presented in Table-4 revealed that flubendamide 480 SC @ 0.4 ml/lit gave the highest monetary returns of rupees 15,853 per ha. It was followed by Rynaxiper 10 SC @ 0.1 ml/lit (rupees 14,943 per ha), Spinosad 45 SC @0.1 ml/lit (rupees 13,023 per ha) and Emamectin Benzoate 5 SG @0.2 g/lit (rupees 12,833 per ha). Assessment of incremental cost benefit ratio (ICBR),revealed the cost effectiveness of Flubendamide 480 SC @0.4 ml/lit with highest ICBR of 1:7. 38 and can be stated as most viable treatment. Application of Indoxicarb 14.5 SC @ 0.5 ml/lit and Emamectin Benzoate 5 SG @ 0.2 g/lit were next in order of economy with ICBR of 1:5.59 & 1:5.42, respectively.

Residue analysis for the effective chemical viz., Flubendamide was analyzed at PTL, DAE, TNAU, Coimbatore & no residues were detected at test concentration in the vegetable produce including the metabolite. Two numbers of parasitoid cocoons was observed in Flubendamide treatment at 3 DAS.

In nutshell, overall superiority of Flubendamide 480 SC 0.4 ml/lit in terms of higher larval reduction, lower pod damage translating into higher yield ad monetary returns was evident during this trial. Flubendamide is an insecticide that is effective against a wide range of Lepidoptera pests. It works by activating the ryanodine receptor in insect muscles, which causes them to stop feeding immediately. This prevents crop damage.

The other promising treatments with distinct advantage were Indoxicarb 14.5 SC @ 0.5 ml/lit and Emamectin benzoate 5 SG 0.2 g/lit which can be used for cost effective management of pod borer complex in field bean. Although, treatment with Rynaxiper is promising in terms of higher population restriction ability, lower pod damage, it lagged on ICBR front on account of higher cost of molecule. These treatments can certainly find a place in case of crop with higher infestation of pod borer.

| *Treatment Details* | *Green pod Yield (Kg/ ha)* | *Mean increase in yield over control (Kg/ha)* | *Cost of increased yield (/ha)* | *Plant protection application cost (/ha)* | *Net Profit (/ha)* | *ICBR* | *Rank* |
|---|---|---|---|---|---|---|---|
| Novaluron 10 EC @ 0.7 ml/lit | 2,030 | 150 | 6000 | 977 | 5,023 | 1:5.1 | V |
| Rynaxiper 10 SC @ 0.1 ml/lit | 2,340 | 460 | 18,400 | 3,457 | 14,943 | 1:4.32 | VI |
| Emamectin Benzoate 5 SG @ 0.2 g/lit | 2,260 | 380 | 15,200 | 2,367 | 12,833 | 1:5.42 | III |
| Spinosad 45 SC @ 0.1 ml/lit | 2,270 | 390 | 15,600 | 2,577 | 13,023 | 1:5.05 | IV |
| Flubendamide 480 SC 0.4 ml/lit | 2,330 | 450 | 18,000 | 2,147 | 15,853 | 1:7.38 | I |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Indoxicarb 14.5 SC @ 0.5 ml/lit | 2,180 | 300 | 12,000 | 1,822 | 10,178 | 1:5.59 | II |
| Untreated check/control | 1,880 | | | | | | |
| SEM | 32.00 | | | | | | |
| SED | 45.25 | | | | | | |
| CD (0.05) | 97.05 | | | | | | |
| Farmer; Standard spray volume :-750 lit of water /ha; Labour charges for spraying; Knapsack spray pump rent; At field market price of field bean/mochai green pods@. | | | | | | | |

***Table 3:*** Consequential yield (Kg/ha) of field bean due to insecticidal application on pod borers.

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